Formalization of the Procedure for Managing the Property Complex of the University

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Abstract: In accordance with the method of analysis of hierarchies, the ranking of property management performance indicators into a hierarchical set containing 4 levels was carried out: goal, groups of indicators, indicators, factors. The procedure for managing the university's property complex has been formalized and the parameters of a rational solution to the set management problem have been identified. The conceptual structure of the decision support system for managing the university's property complex has been built. A functional model of the system has been developed. The projected decision support system includes the following subsystems: a subsystem for processing expert opinions, a subsystem for generating accounting data for fixed assets, a subsystem for making decisions on the effectiveness of university property management.

Keywords: property complex management efficiency, functional model, fixed assets, decision support system, profile usage indicators, hierarchical model.

Introduction

Achieving effective management of fixed assets (OS) should be accompanied by the improvement of information support based on the development of models and algorithms [4]. The complexity of the task of managing the property complex of a university is influenced by the multidimensionality of ongoing processes (technical, economic, legal, etc.) and their interrelations, a large number of different types of indicators, the presence of uncertain dependencies, and characteristics that determine the state of the property complex of a university [5]. These circumstances lead to the fact that management decision support systems are used to solve the control problem [6].

The purpose of the study is to form a system of indicators for assessing the current situation in the university when making a decision to improve the efficiency of the functioning of the property complex of the university.

The state C_b, characterized by the deviation of the indicators of the property complex of the university $X = (X_1, X_2,..., X_n)$ from the normative values, will be considered as a problem situation. We will consider the measurement and assessment of the problem situation in the management of the property complex of the university on the vector of indicators by defining some evaluation function:

$$\psi_x(M) = (\varphi(x_1), \varphi(x_2),..., \varphi(x_n)).$$

As a result, estimates of indicators of the property complex of the university $(x_1, x_2, ..., x_n)$ were formed. The level of deviation from the normative values Δ is defined as the value of the discrepancy between the values of the current and normative indicator of the property complex of the university x_j and x_j^0, where $\Delta = \varphi(x_j) - \varphi(x_j^0)$. Improving the efficiency of managing the property complex of a university is possible if the value Δ does not exceed a certain threshold

value δ_{Π} or critical value $\delta_{\kappa p}$:

$$(\Delta > \delta_{\Pi}) \vee (\Delta > \delta_{\kappa p})$$

There are situations C_j in which, at some point in time, the deviation of indicators X from the normative values leads to an increase in δ_{Π} or $\delta_{\kappa p}$ values of indicators of the property complex of the university, which is defined as a problem situation C_b [6]:

$$\exists X \forall C(C_j \| (\Delta_j > \delta_{\Pi}) \vee (\Delta_j > \delta_{\kappa p}) \| = \varphi(x_j) - \varphi(x_j^0)) \to C_0.$$

The elimination of a problematic situation C_b can be formulated as an impact on the existing state by a multitude of influencing factors (see Fig. 2, the level of factors). Such an impact will lead to a change in the initial state C_b and a transition to a certain target state C_{end} in the direction of increasing the efficiency of the property complex of the university S:

$$Rh : C_b \to C_{end} \big|_{T, I_1, R}$$

under restrictions on the transition time (changes in the initial state) T; the information volume required for the implementation of such a transition I_1; management resources R for the implementation of management decisions (see Fig. 1, level 3); influencing the initial situation through influencing factors (see Fig. 2, the level of factors).

The effective solution Rh depends on the following parameters [4].

1. The quality, quantity and methods of using various types of management resources available to achieve the target state C_{end}, i.e. $R = \{R^-, R^~\}$, where R^- are constant management resources, i.e. not changed in the process of solving the problem (laboratory, computer, etc. types of university equipment, personnel, laboratory complexes, etc.); $R^~$ - variable resources, i.e. resources that change depending on the volume of the problem, for example, finance, investments, materials, components.

2. Uncontrollable factors (inflation, staff turnover, equipment failures, repairs, etc.), certain and uncertain factors (changes and adjustments in the use of classrooms, changes in norms and standards, etc.).

3. Results (outcomes - the consequences of the development of the decision), which can lead to the chosen strategy and the action of uncontrollable factors.

4. A system of preferences showing the extent to which the target state C_{end} can be achieved for various outcomes.

The decision maker must assess the significance of the individual components of the situation and the situation as a whole, consider possible solutions, evaluate their consequences and the effectiveness of each decision, choose the best solution, from his point of view [5]. Let's consider the implementation of these processes in the form of a conceptual structure of the decision support system for managing the property complex of a university with detailing up to the level of a functional model.

The conceptual structure of the decision support system for managing the property complex of the university.

The architecture of the decision support system (DSS) for evaluating the effectiveness of the property complex of the university is presented as a set of interacting functional elements (Fig. 1).
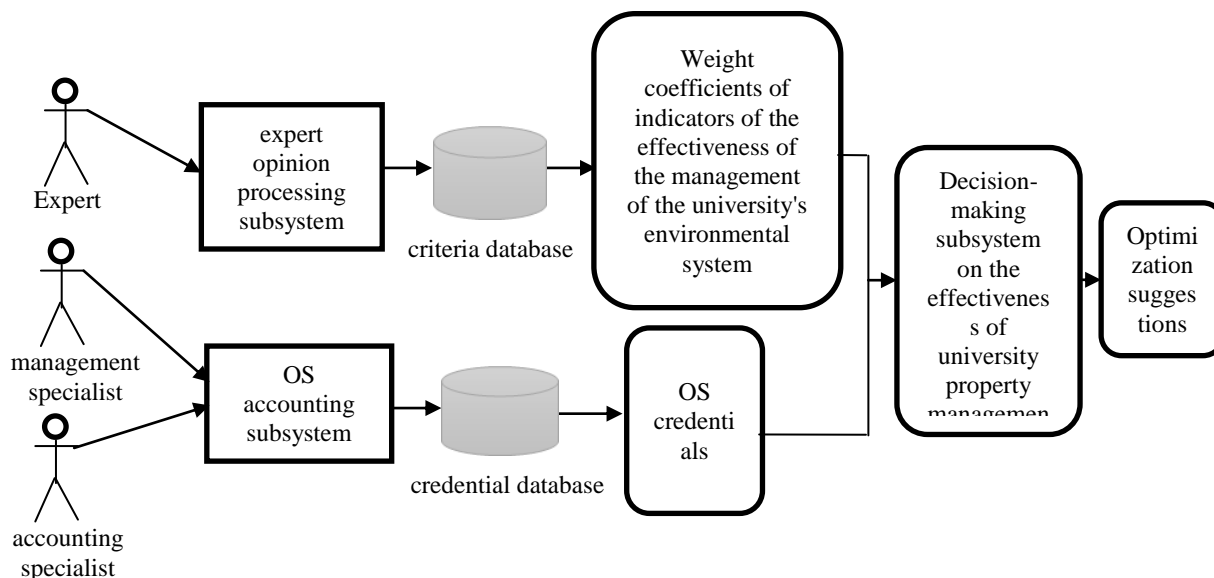
Fig.1. Architecture of the DSS for assessing the effectiveness of the university's OS management

The main semantic elements of the DSS are the subsystem for processing expert opinions, the subsystem for generating OS credentials, the bases of criteria and credentials, the subsystem for making decisions on the effectiveness of managing the property of the university, the subsystem for generating proposals for optimizing the management of the property complex of the university. An expert in the structure of the DSS determines the weighting coefficients of the university's environmental management efficiency indicators. Specialists of the accounting department and the property management department load and consolidate the relevant OS credentials in the DSS.

To build a functional model of the DSS for assessing the effectiveness of managing the property complex of a university, the information apparatus of data flow diagrams was used (Fig. 2).
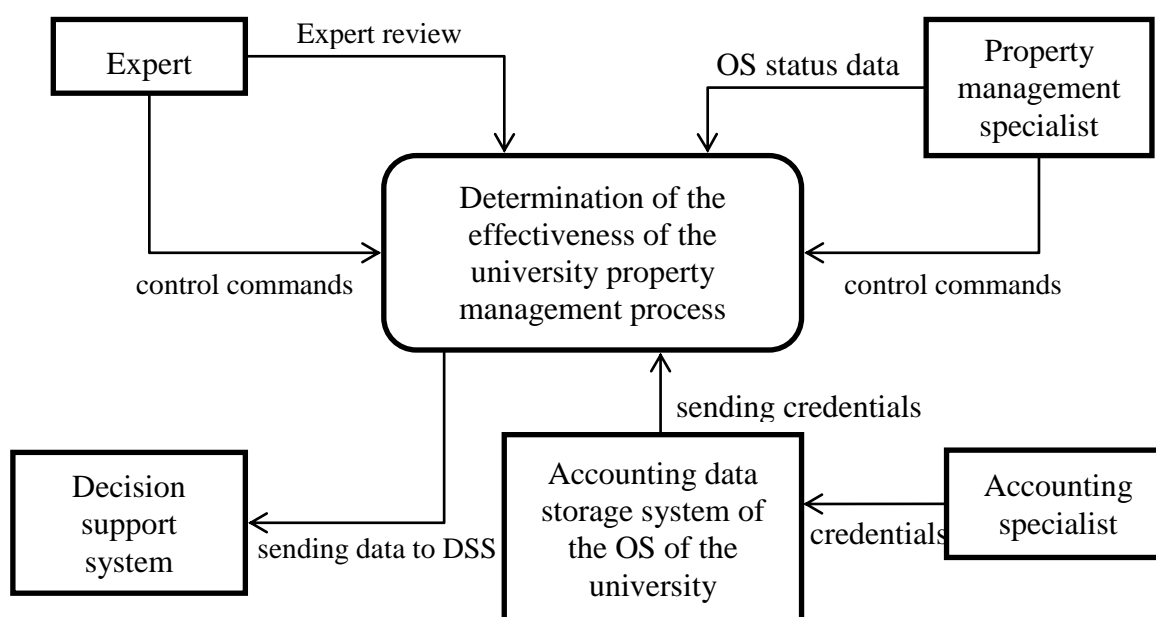

Fig.2. Functional model of DSS

The functional model of the DSS consists of the following entities:

➢ an expert providing the results of the significance of the indicators;

➢ a specialist of the property complex management department, who enters the necessary data on the state of the object of the property complex of the university;

➢ an accounting specialist who uploads credentials to calculate the performance indicators of the university's property complex;

➢ the decision support system provides support in optimizing the performance indicators of university property management;

➢ A system for storing credentials of the OS of the university, which contains the data necessary for calculating the indicators.

Conclusion

A conceptual model of a decision support system for managing the university's property complex is proposed. Based on the conceptual model, a general functional model of the system is formed. Implementation of the management decision support system for the management of the property complex of the university will ensure effective management of fixed assets and will result in a reduction in energy consumption by an average of 10%, a reduction in equipment maintenance costs by an average of 15% due to predictive maintenance.

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